

HATCHERY AND GENETIC MANAGEMENT PLAN

Hatchery Program:

Lower Elwha Fish Hatchery

**Species or
Hatchery Stock:**

Coho; *Oncorhynchus kisutch*

Agency/Operator:

Elwha Klallam Tribe

Watershed and Region:

Elwha River; WRIA 18.0274

Date Submitted:

06.30.2000

Date Last Updated:

03.14.2003



HATCHERY AND GENETIC MANAGEMENT PLAN LOWER ELWHA FISHERIES OFFICE COHO SALMON ENHANCEMENT PROGRAM

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Lower Elwha Fish Hatchery: Coho salmon program

1.2 Species and population (or stock) under propagation and ESA status: Coho salmon, *Oncorhynchus kisutch*. Not identified as threatened or endangered.

1.3 Responsible organization and individuals:

Name (and title): Larry Ward, Fisheries Biologist

Agency or Tribe: Elwha Klallam Tribe

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Other agencies, Tribes, co-operators, or organizations involved including contractors and extent of involvement in the program:

Bureau of Indian Affairs: provides facility operating and maintenance budget (PL-638)

Point No Point Treaty Council: provides fisheries management support services

Northwest Indian Fisheries Commission: provides fisheries management support services, provides grant support, provides diagnostic fish health services

Washington Department of Fish and Wildlife. Co-manager with the Elwha Tribe on the Elwha River salmon fishery resource.

North Olympic Salmon Coalition: provides grant support for on-going research projects

1.4 Funding source, staffing level, and annual hatchery program operational costs:

Funding via Bureau of Indian Affairs (PL-638),

Staffing level: 4

1.5 Location of hatchery and associated facilities:

Name of stream: Elwha River

River mile location: 0.25

Basin name: Elwha River

State: Washington

Watershed code: 18.0274

Regional mark processing center code: 99702

GIS entry information: lat/long: 123.33.00; 48.08.30

1.6. Type of program: Integrated harvest

1.7. Program goal: The goal of the Lower Elwha Fish Hatchery coho salmon plan is to

1.7.1 Maintain coho salmon stocks for in-river terminal harvest opportunities

1.7.2 Minimize adverse ecological and behavioral effects upon listed stocks of chinook salmon

1.8 Program Goal and Justification: The hatchery program will be operated to:

1.8.1 Provide fish for harvest opportunities (commercial, ceremonial, subsistence, sport)

1.8.2 Minimize adverse ecological and behavioral effects upon listed stocks of chinook salmon

1.9 and 1.10) Program performance standards and indicators

Program Goal	Performance Standard	Performance Indicator
1.8.1 Provide fish for harvest opportunities	Hatchery production of 750,000 smolts contribute to harvest and escapement goals and maintains Tribal Treaty harvest rights by providing surplus coho for in-river fisheries	Tribal treaty harvest upon coho are continued
		Annual targeted harvest rates of hatchery stocks are not exceeded
		An average terminal exploitation rate of 11.75%
		Cultural events focusing upon salmon-based traditions continue
	Hatchery production of coho salmon meets the juvenile goal of 750,000 smolts	A hatchery escapement goal of 1,600 brood stock is attained
		1,600 broodstock for hatchery escapement which will produce necessary component of minimum spawners
		1,200 spawners which will produce eggs necessary to meet annual hatchery production goal
		Egg take of 1.2 million eggs will achieve an overall survival sufficient to produce 750,000 outmigrating smolts from the hatchery
	Fish diseases will be detected and treated when necessary to maintain and improve health in hatchery production	Returning adult broodstock will be tested at levels sufficient to detect viral and bacterial infections
		Eggs will receive appropriate disinfection during incubation period to minimize fungal and bacterial infections
		Health of hatchery stocks will be monitored on a monthly basis and preventative actions/strategies to maintain fish health will be recommended
		Health status of pre-smolts will be assessed prior to release from the facility
1.8.2 Minimize adverse ecological and behavioral effects upon listed stocks of chinook salmon	Hatchery production of coho salmon has a minimal impact on the numbers and survival of listed salmon stocks	Aggressively pursue the implementation and review of NATURES rearing methodology and disseminate the results of this research regionally
		In-river terminal harvests of non-listed species scheduled to limit (prevent?) harvest of adult chinook
		Adult chinook are not targeted by broodstock capture program, adult chinook volunteering to hatchery rack are returned to river or transported to WDFW Elwha Rearing Channel
		Release of coho smolts is delayed until chum and pink salmon smolts have emigrated or have reached a length of 45 mm
		Release of coho smolts completed prior to release of chinook smolts from WDFW facility

1.11 Expected program size

1.11.1 Proposed annual broodstock collection level: 1,200 adults

1.11.2 Proposed annual release levels: 750,000 yearling smolts

1.12 Current program performance (1988 to present)

1.12.1 Survival rates

TABLE 1.12.1 COHO SALMON SURVIVAL RATES

Life Stage	Percent Survival
Hatch to Fry	90.2
Fry to Fingerling	88.5
Fingerling to Smolt	95.1
Smolt to Adult	Pending

- 1.12.2 Total adult production number: natural population size is unknown, but for purposes of FRAM modeling is assumed to be 2.08% of hatchery run size.
- 1.12.3 Average facility escapement: 2,219 (838 jacks, 759 females, 622 males)
- 1.13 Program initiation date: 1978 (22 years)
- 1.14 Expected program duration: undefined
- 1.15 Targeted watersheds: Elwha River watershed; WRIA 18.0274
- 1.16 Alternative actions: None. Migration of adults into upper Elwha River basin is blocked by Elwha and Glines hydroelectric projects

SECTION 2. PROGRAM EFFECTS ON ESA LISTED SALMONID POPULATIONS

- 2.1 ESA permits/authorizations in hand for hatchery program: none
- 2.2 ESA-listed natural populations in target area
 - 2.2.1 Description of ESA-listed salmonid population:
 - stock: Elwha Fall Chinook, hatchery origin stock
 - adult age class structure: (1993 data) Age 3: 13.4%, Age 4: 20.6% Age 5: 64.9% Age 6: 1%
 - sex ratio: Male: 54.6% Female: 45.4%
 - size range: NA
 - migration timing: Adult entry July to September, spawning August to October; hatch: December to January, out-migration June.
 - juvenile life history strategy: Hatchery population is sub-yearling smolts
 - 2.2.1.1 ESA-listed stock directly affected by the program: None
 - 2.2.1.2 ESA-listed stock incidentally affected by the program: Elwha River Fall Chinook Salmon (hatchery origin stock)
 - 2.2.2 Status of ESA-listed salmonid population affected by the program:
 - 2.2.2.1 Status: critical
 - 2.2.2.2 Annual abundance estimates of Elwha River chinook salmon (1988-1999)

TABLE 2.2.2.2 ANNUAL ABUNDANCE OF ELWHA RIVER CHINOOK SALMON

Year	Escapement	Terminal Run	Pre-Terminal Catch
1988	7,873	8,666	417
1898	5,487	5,703	113
1990	3,180	3,605	39
1991	3,469	3,761	63
1992	3,859	4,002	54
1993	1,569	1,669	26
1994	1,546	1,580	42
1995	1,812	1,814	38
1996	1,875	1,883	7
1997	2,527	2,571	44
1998	2,409	2,418	7
1999	1,649	1,651	5
2000	1,959	1,966	6
2001	NA	1,913	NA
2002	NA	2,246	NA

- 2.2.3 Hatchery activities that may have led to the take of listed fish in the target area: Elwha River chinook salmon adults of hatchery origin have in past years entered the trap at the Lower Elwha Fish Hatchery. Total observed returns number less than 50 in the past ten years. Chinook salmon encountered at the hatchery are

separated from non-listed species and are either transported to the WDFW Elwha Rearing Channel or are returned to the Elwha River

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

- 3.1 Alignment of the hatchery program with any ESU-wide hatchery plan: The hatchery program will be operated consistent with the Puget Sound Salmon Management Plan; The Draft Comprehensive Coho Management Plan; The Draft Comprehensive Chinook Management Plan; and The Salmonid Disease Control Policy of the Fisheries Managers of Washington State.
- 3.2 All cooperative agreements, memoranda of understanding, or other management plans or court orders under which the program operates: None in place.
- 3.3 Program relationships to harvest objectives: Artificial propagation and harvest management are directly linked to hatchery operation in order to maximize benefits and minimize biological risks to the listed species detailed in Puget Sound Salmon Management Plan. The hatchery is operated in a manner consistent with the Puget Sound Salmon Management Plan; the Draft comprehensive Coho Management Plan; and the Draft Comprehensive Chinook Management Plan.
- 3.3.1 Management Plan Fisheries benefiting from the program: Pre-terminal fisheries, Elwha River terminal net fishery (Tribal), terminal Ceremonial and Subsistence (Tribal), and terminal sport harvest (recreational).

TABLE 3.3.1 FISHERIES BENEFITING FROM LOWER ELWHA FISH HATCHERY COHO SALMON PROGRAM

Year	Pre-Terminal ¹	Terminal Commercial	Terminal Ceremonial & Subsistence	Terminal Recreational
1988	3,674	1,138	0	51
1989	7,455	3,169	95	156
1990	7,237	1,458	4	6
1991	1,683	523	3	52
1992	4,642	1,155	31	371
1993	2,364	128	13	67
1994	876	253	3	374
1995	3,454	2,175	5	256
1996	5,719	1,154	20	179
1997	7,150	57	28	107
1998	579	1,756	85	909
1999	346	2,600	144	1,446
2000	120	1,528	221	258
2001	935	2,705	1,224	943
2002		2,761	384	

1. Pre-terminal harvest rate does not include non-landed mortality

- 3.4 Relationship to habitat protection and recovery strategies: Production of coho salmon in the Elwha River is severely limited by two hydroelectric projects located at RM 4.9 and 12.1 on the Elwha River. These dams lack fish passage structures and block access by salmon to all but the lower five miles of mainstem habitat. In addition, these two hydroelectric projects have prevented sediment and large woody debris transport from occurring, severely degrading the lower portions of the river.

Short-term recovery and protection: Recovery and protection efforts have focused upon maintenance of critical spawning and rearing habitat in the river and the restoration of mainstem habitat through the installation of engineered log jams.

Long-term recovery and protection: Recovery and protection efforts will focus upon the Elwha River Ecosystem Restoration Act (PL 102-495). The act details the benefits and impacts to fish populations, their recovery and protection on the Elwha River resulting from the removal of the Elwha and Glines hydroelectric projects.

- 3.5 Ecological interactions: Hatchery fish can interact with listed fish species through competition and predation (Fresh 1997). Program fish can negatively impact listed fish through reduced growth, survival and abundance. Several methods have been developed to assess potential negative ecological interactions and risks associated with hatchery programs (Pearsons and Hopley 1999; Ham and Pearsons 2001). The degree to which fish interact depends upon fish life-history characteristics which include: 1) size and morphology, 2) behavior, 3) habitat use and 4) movements (Flagg et al. 2000). Important considerations associated with hatchery practices include the type of species reared, fish size at time of release, number of fish released and location(s) of program releases. Interaction potential between hatchery origin fish and natural origin fish can certainly depend on habitat structure and system productivity. For example, habitat structure can influence predator-prey encounter rates (visibility), the amount of preferred spawning habitat and fish susceptibility to flushing flows. System productivity determines the degree to which fish populations may be food-limited, and thus negatively impacted by density-dependent effects. The type and degree of risk associated with releases of program fish typically involve complex mechanisms. Actual identification and magnitude of causal mechanisms negatively impacting listed fish is not always definitive due to confounding factors such as human-induced environmental changes, indirect pathway effects and the diversity of environments salmon occupy throughout their life-cycle (Li et al. 1987; Fausch 1988; Fresh 1997; Flagg et al. 2000). Given these complex mechanisms and site-specific considerations it is not surprising that for most hatchery programs, the extent of possible adverse competition and predation effects of hatchery releases on listed fish populations throughout Puget Sound have not been explicitly documented or qualified.

Given the perceived risks associated with hatchery programs, hatchery coho salmon are reared and released in a manner to minimize potential negative impacts on listed chinook salmon and bull trout populations (see Section 10.11).

Releases of yearling coho salmon certainly pose a predation risk on juvenile fall chinook and chum salmon, both in the freshwater and marine environment (Hargreaves and LeBrasseur 1985; Hawkins and Tipping 1999; Pearsons and Fritts 1999). Actual rates of predation by program release of yearling coho salmon on juvenile chinook and chum salmon are unknown at this time. Outmigration timing studies scheduled to commence Spring 2003 will attempt to document the existence of predation of coho salmon on threatened and endangered stocks of natural-origin fish (see Section 12).

- 3.5.1 Species that could negatively impact program: sea lions, seals, river otters, piscivorous birds,
- 3.5.2 Species that could be negatively impacted by the program: fall chinook, steelhead, fall chum, pink salmon
- 3.5.3 Species that could positively impact the program: Chinook, steelhead, chum, and pink salmon
- 3.5.4 Species that could be positively impacted by the program: sea lions, seals, river otters, piscivorous birds,

SECTION 4. WATER SOURCE

- 4.1 Facility water source: Facility water is a mix of surface and ground water. Water quality of the facility is similar to that found in the Elwha River. Water temperature profile will be cooler during the summer and warmer during the winter due to the influence of the ground water component.

Surface water: Water is collected from a gravity-flow infiltration located at RM 1.5 of the Elwha River. Flow produced by this system varies seasonally from 600 GPM to 2,000 GPM. Historically this system produced 4,500 GPM.

Ground water: Two wells on the facility contribute a total of 1,400 GPM to the facility. Historical groundwater production levels averaged 2,000 GPM.

Permits: National Pollutant Discharge Elimination System (NPDES). *Tribal Hatcheries and Other Upland Aquaculture Facilities in the State of Washington.* Permit No. WA-G13-1000 (pending).

Compliance with NMFS screening criteria: No screening exists on surface water system. Water is acquired from a subsurface gravel filter.

- 4.2 Risk aversion measures to be applied: No listed species of salmon will be impacted by water withdrawals carried out by the facility. Listed adults which enter the hatchery by means of the hatchery outfall will either be returned to the Elwha River, or will be transported to the WDFW Elwha Rearing Channel for use in their production program.

SECTION 5. FACILITIES

- 5.1 Broodstock collection facilities: Brood fish are permitted to voluntarily return to the facility. Fish enter the facility by means of an outfall creek constructed for the hatchery. At the head of the outfall creek is a trap with the fish enter. In the trap fish are sorted one to two times per week for species, sex, and state of sexual ripeness. Green males and females are held separately prior to spawning.
- 5.2 Fish transportation equipment: No use of transport is made in the program.
- 5.3 Broodstock holding and spawning facilities: Holding facilities for the program consist of a .75 acre earthen pond divided into three sections: the trap, a section for females and a section for males. Spawning facilities for the program consist of two sheds. In these sheds fish are killed, bled and spawned.
- 5.4 Incubation facilities: The program uses an incubation facility with a maximum instantaneous incubational capacity of 6.7 million eggs. The facility is located on the hatchery grounds and is served by ground water, surface water, or a combination of the two sources.
- 5.5 Rearing facilities: The hatchery's rearing facility consists of 24 concrete raceways, eight fiberglass circular tanks, 4 asphalted rearing ponds and an earthen rearing pond.
- 5.6 Acclimation/release facilities: Fish are released directly from rearing ponds. No additional acclimation facilities are used in the program.
- 5.7 Operational difficulties/disasters which have led to significant fish mortality:
- 5.7.1 Flooding: Flooding has inundated broodstock holding facilities in the past, washing fish out from the adult holding ponds, stranding fish in the woods post-flood. Floods have inundated rearing ponds washing juvenile fish from the ponds.
- 5.7.2 Electrical power outages: Loss of electrical power resulted in pump failure and loss of groundwater production.

- 5.7.3 Emergency standby generator failure: Corrosion of generator computer components caused the generator to fail to start. Due to the system age, many of these components are no longer available as stock items and require production lead times of between three and five weeks to fabricate.
- 5.7.4 Pump failure: Shaft bearing failure on turbine pump caused pump shaft shear and loss of groundwater production.
- 5.7.5 Loss of groundwater: Elwha River channel migration has reduced the production potential of groundwater sources serving the hatchery facility.
- 5.7.6 Loss of groundwater: Migration of fines and fouling of intake screens by bacteria has reduced the production potential of the groundwater wells serving the hatchery facility.
- 5.7.7 Loss of surface water: Elwha River channel migration has reduced the production potential of groundwater sources serving the hatchery.
- 5.7.8 Theft of fish: Theft of adult broodfish resulted in the failure to achieve egg take goals (1988).
- 5.7.9 Disease outbreaks: Historical disease outbreaks include: *R. salmoninarum*, *F. psychrophilum*, *Trichodina sp.*, *Epistylis*, *sp.*
- 5.7.10 Mammalian predation: Predation by piscivorous mammals has resulted in the loss of an undocumented number of juvenile salmonids.
- 5.7.11 Avian predation: Predation by piscivorous birds have resulted in the loss of an undocumented number of juvenile salmonids.
- 5.8 Backup systems/risk aversion measures in place
 - 5.8.1 Flooding: A flood reduction levee has been constructed by the US Army Corps of Engineers to address the issue of flooding. During flood events a flap-gate on the hatchery outfall is closed preventing the entry of floodwaters into the hatchery facility. During these flood events, flap-gate closure prevents either the return of adults to and the releases of juveniles from the hatchery.
 - 5.8.2 Electrical power outages: Local PUD has upgraded the service entrance and transmissions lines leading to the facility.
 - 5.8.3 Emergency standby generator: Computerized components for the generator system have been replaced and have been weatherized.
 - 5.8.4 Pump failure: Pump production and operation is monitored regularly. Pumps receive regular servicing and inspections.
 - 5.8.5 Fish theft: An infrared security system has been installed and is monitored 24/7.
 - 5.8.6 Disease outbreaks: Fish health is monitored pro-actively. Rearing conditions are maintained to promote those levels identified as optimal for fish health. Adult females are injected with erythromycin to limit possible bacterial disease impacts
 - 5.8.7 Predation: Netting systems have been upgraded to limit effects of avian predation. No risk aversion measures have been taken to limit mammalian predation.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

- 6.1 Source: Elwha River stock returning to the hatchery rack
- 6.2 Supporting information
 - 6.2.1 History: The coho program at the Lower Elwha Fish Hatchery began in 1978 utilizing Elwha River broodstock. Since commencing operation, the hatchery has received one importation of eggs from the WDFW Dungeness Hatchery (645,000 eyed eggs, brood year 1988).
 - 6.2.2 Annual size: Naturally spawning population: Size unknown, but for purposed of FRAM modeling is assumed to be 2.08% of hatchery run size.
Average calculated total run size: 3,157

- Average facility returns: 2,219 (838 jacks, 759 females, 622 males)
- 6.2.3 Past and proposed level of natural fish in broodstock: The number of natural fish incorporated into the hatchery program annually is unknown, however scale analysis (1997) show no natural-origin fish represented in the hatchery population.
- 6.2.4 Genetic or ecological differences: There are no known differences between natural spawning and hatchery populations. Run timing between the two populations is identical. Eggs are taken from the entire run period.
- 6.2.5 Reason for choice of stock: Selection of the stock was based upon its localized adaptation, unique genetic composition, run timing characteristics, tribal cultural priorities, and stock availability.
- 6.3 Risk Aversion measures to be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices: No known adverse genetic or ecological effects to listed natural fish will result from current coho salmon broodstock selection practices.

SECTION 7 BROODSTOCK COLLECTION

- 7.1 Life history phase collected: Adults
- 7.2 Collection or sampling design: Coho production goals are achieved through the volitional return of fish into an adult capture facility located at the hatchery. The hatchery collects and spawns fish from throughout the run period to insure representation of all portions of the run timing spectrum. Eggs taken in excess of production goals are culled proportionally through all egg take lots.
- 7.3 Identity: All fish returning to the hatchery facility are included in egg-take operations. Identity of hatchery-origin fish was re-affirmed during a 1997 scale analysis. Scales from fish spawned at the hatchery showed that no wild-origin fish had been incorporated into the hatchery program.
- 7.4 Proposed number to be collected:
- 7.4.1 Program goal: 1,200 adults
- 7.4.2 Broodstock collection and hatchery production levels for last 12 years

TABLE 7.4.2 BROODSTOCK COLLECTION, EGG TAKES AND RELEASES

Year	Females	Males	Jacks	Eggs	Fecundity	Juveniles
1988	NA	NA	NA	285,240	2,008	768,604
1989	789	366	81	1,664,878	2,398	668,646
1990	687	435	22	1,297,352	2,398	755,621
1991	425	352	264	725,380	3,504	580,000
1992	788	687	690	2,394,074	3,484	707,713
1993	742	581	542	1,176,331	1,885	801,000
1994	624	510	1,101	1,378,818	2,582	722,221
1995	1,040	835	2,671	1,492,205	3,415	644,227
1996	1,243	1,169	788	1,678,085	2,864	867,379
1997	523	409	723	905,436	1,844	905,436
1998	867	632	943	1,178,353	3,335	684,856
1999	2,103	1,704	1,861	1,578,698	2,368	789,010
2000	1,090	792	950	1,362,639	2,384	662,231
2001	2,964	2,904	910	1,057,101	2,676	Pending
2002	2,115	1,601	431	1,377,991	3,588	Pending
Average	1,143	927	856	1,303,505	2,716	674,685

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs: Fish collected in excess of hatchery production needs are not returned to the river to spawn with naturally spawning populations. Fish are killed, sampled for coded wire tag information, and are either: surplused to Tribal cultural programs, donated to regional food banks, or are used in carcass nutrient enrichment programs in the Elwha River basin.

7.6 Fish transportation and holding methods: No transport of brood fish occurs. Upon entering the hatchery trap/holding facility (earthen pond) fish are sorted for species, sex, and state of sexual ripeness. Green males and females are held separately. Green females, upon entering the facility receive an injection of erythromycin (30 mg/kg) as a prophylaxis against *Renibacterium salmonarum*, the causative agent of bacterial kidney disease. Fish receiving this injection are not made available for human consumption or nutrient enrichment programs.

7.7 Fish health maintenance and sanitation procedures: No fish health maintenance procedures are conducted during the pre-spawn holding period at the hatchery facility. Pre-spawning mortalities are removed from the pond, sampled for coded wire tags, and are disposed of by either burial or in-river carcass nutrient enrichment.

7.8 Carcass Disposition:

TABLE 7.8 CARCASS DISPOSITION

Carcass condition	Disposition
Jack unspawned	Surplused
Jack spawned	Carcass nutrient enrichment
Male unspawned	Surplused or carcass nutrient enrichment
Male spawned	Carcass nutrient enrichment
Female unspawned	Surplused, buried or carcass nutrient enrichment
Female spawned	Carcass nutrient enrichment or buried

7.9 Risk aversion measures employed to minimize adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection process: Any chinook salmon which enter the Lower Elwha Fish Hatchery adult collection facility shall be

either returned to the Elwha River or transferred to the WDFW Elwha Rearing Channel (for incorporation into the artificial propagation program there).

SECTION 8. MATING

- 8.1 Selection method: spawners are selected randomly from ripe fish on a given day.
- 8.2 Males: No repeat spawners are utilized. Precocious males are used at a rate equivalent to 3 to 5% of the total males used in the spawning program.
- 8.3 Fertilization: Females are spawned and eggs from 20 females are pooled. These eggs are randomly mixed and divided into 7 lots. Eggs are rinsed with a buffered sodium bicarbonate solution to remove debris and promote sperm motility. The rinse solution is then poured-off.
Males are spawned and sperm is held separately for each fish. Sperm from three males (one principal, two back-ups) are added to each of the 7 lots of eggs and is mixed. Water is added to initiate sperm motility. Eggs are loaded into vertical tray incubators and allowed to water-harden for 60 minutes in 3 liters of 100 PPM buffered PVP iodine solution. Following water-hardening incubation flows are begun at 3.0 GPM.
- 8.4 Cryopreserved Gametes: No use of cryopreservation is employed in the coho salmon program at the hatchery.
- 8.5 Risk aversion measures employed to minimize adverse genetic or ecological effects to listed natural fish resulting from the mating scheme: No known adverse genetic or ecological effects to listed natural fish will result from current coho salmon mating practices employed at the Lower Elwha Fish Hatchery.

SECTION 9. INCUBATION AND REARING

9.1 Incubation

- 9.1.1 Number of eggs taken and survival rates to eyed-up and/or ponding:

TABLE 9.1.1 COHO EGG TAKE LEVELS AND SURVIVAL

Year	Green Eggs Taken	Percent Survival to Eyed Stage
1988	285,240*	NA
1989	1,664,878	74.8
1990	1,297,352	95.1
1991	725,380	91.1
1992	2,394,074	93.0
1993	1,176,331	94.7
1994	1,378,818	93.2
1995	1,492,205	95.7
1996	1,678,085	94.2
1997	905,436	93.0
1998	1,178,353	88.8
1999	1,578,698	83.7
2000	1,362,639	95.3
2001	1,057,101	92.1
2002	1,377,991	84.7
Average	1,376,239	90.7

* received 600,000 eyed eggs from WDFW Dungeness Fish Hatchery

- 9.1.2 Cause for, and disposition of surplus egg takes: Excess eggs are taken in order to guard against loss of eggs during incubation and rearing and to gain insure that the egg take proportionately represents all segments of the run timing

spectrum. Eggs taken in excess of program needs are either destroyed or are sold to egg brokers for export overseas. Resulting coho fry in excess of program needs are destroyed to avoid exceeding programmed fish production levels.

9.1.3 Loading densities applied during incubation

9.1.3.1 Egg size data (egg weight)

TABLE 9.1.3.1 COHO EGG SIZE

Year	Egg Size (eggs/gm)
1992	4.37
1993	4.71
1994	4.68
1995	3.86
1996	4.49
1997	4.66
1998	3.76
1999	4.36
2000	4.30
2001	3.80
2002	4.22
Average	4.29

9.1.3.2 Standard incubation flows: 3.0 GPM

9.1.3.3 Standard Loading per Heath Tray (eggs/tray)

TABLE 9.1.3.3 COHO EGG INCUBATIONAL LOADING DENSITIES

Year	Green to Eyed				Eyed to Hatch			
	Range	Eggs/Tray	Grams /Tray	Grams /GPM	Range	Eggs/Tray	Grams /Tray	Grams /GPM
1989	10,216-4,994	7,494	1,719	572	na	na	na	na
1990	14,858-3,567	7,929	1,818	606	7,851 – 3,096	4,919	1,128	376
1991	11,069-4,678	8,349	1,915	638	8,313 – 3,135	4,584	1,051	350
1992	9,337-5,668	8,013	1,838	612	5,493 – 4,081	4,582	1,051	350
1993	9,631 – 5,846	7,985	1,831	610	5,945 – 4,200	4,687	1,075	358
1994	9,124 – 6,319	8,035	1,842	422	5,028 – 3,277	4,227	969	222
1995	11,989 - 7,054	9,403	2,156	494	5,775 – 3,750	4,550	1,044	239
1996	8,977 – 5,385	7,529	1,727	396	6,015 – 4,121	5,132	1,177	270
1997	11,474 - 3,754	6,735	1,544	354	6,335 – 4,141	5,053	1,159	266
1998	10,115 – 7,238	8,464	1,941	445	5,813 – 4,073	4,969	1,140	261
1999	11,474 – 3,754	6,735	1,544	514	6,335 – 4,141	5,053	1,159	265
2000	7,361 to 5,432	6,688	1,555	518	6,903 to 5,534	6,299	1,465	488
2001	10,000 to 6,451	8,674	2,283	761	5,758 to 5,545	5,663	1,490	497
2002	11,714 to 9,890	10,449	2,476	825	6,101 to 4,877	5,541	1,313	438
Average		8,034	1,871	555		5,020	1,171	337

9.1.4 Incubation conditions: Incubation facility is supplied by constant temperature ground water. Incubational development is tracked on a weekly basis. Eggs are shocked, sorted to remove non-viable eggs, inventoried, and retrayed prior to hatching. Eggs are retrayed in Heath trays with triple-layer of Vexar screening to inhibit coagulated yolk condition. No siltation occurs during incubation process.

9.1.5 Ponding:

Degree of button-up: mostly buttoned-up. Small suture remains visible at time of ponding.

Cumulative temperature units: 1,275 CTU° F

Mean length: unknown

Mean weight: 0.378 grams/fish

9.1.5.1 Start dates of ponding

TABLE 9.1.5.1 COHO FRY PONDING DATES

Brood Year	First Ponding Date	Final Ponding Date
1988	02.22.1989	03.30.1989
1989	03.08.1990	04.06.1990
1990	02.14.1991	03.27.1991
1991	01.16.1992	02.23.1992
1992	01.22.1993	02.25.1993
1993	02.11.1994	04.04.1994
1994	01.13.1995	02.25.1995
1995	01.25.1996	02.29.1996
1996	01.29.1997	03.30.1997
1997	01.22.1998	03.10.1998
1998	02.10.1999	03.22.1999
1999	02.12.2000	03.29.2000
2000	01.17.2001	02.26.2001
2001	01.17.2002	02.22.2002
2002	02.07.2003	04.02.2003

9.1.5.2 Method of swim-up and ponding: forced (fish transferred manually to early-rearing raceways).

9.1.6 Fish health maintenance and monitoring: Fungus controlled by means of formalin drip treatments (166 PPM for 15 minutes, 3 days of treatment per 10 days rearing).

9.1.6.1 Disease monitoring: Viral broodfish monitoring: 60 fish monitored for ovarian fluid. All tissues incubated on EPC and CHSE-214 cell lines at 15°C for 21 days. Samples tested in five fish pools or less. BKD: 150 females sampled. Kidney-spleen homogenates tested by direct fluorescent antibody techniques in pools of five fish or less (Salmonid Disease Control Policy for the Fisheries Co-Managers of Washington State).

9.1.6.2 Yolk-sac malformation incidence: Yolk sac malformations are not observed in eggs. Egg incubation strategies are employed (3.0 GPM flows and use of incubational substrate) to prevent these malformations from occurring.

9.1.6.3 Egg mortality removal methods: At eyed stage eggs removed mechanically and manually. Mortalities experienced following rearing of eggs are not removed until ponding of fry.

9.1.7 Risk aversion employed to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation: Incubation will not genetically and ecologically effect listed fish.

9.2 Rearing

9.2.1 Survival data by hatchery life stage for the most recent 12 years

TABLE 9.2.1 COHO SURVIVAL RATES

Brood Year	Fry to Fingerling	Fingerling to Smolt
1988	NA	NA
1989	83.9	89.6
1990	75.4	85.4
1991	NA	NA
1992	79.9	98.5
1993	91.4	99.3
1994	98.8	99.2
1995	98.8	99.9
1996	90.5	99.0
1997	97.1	99.6
1998	99.5	99.5
1999	76.8	76.8
2000	100	93.8
2001	93.3	Pending
2002	Pending	Pending

9.2.2 Density and loading criteria (goals, actual levels, and observed extremes)

TABLE 9.2.2 COHO PRODUCTION LOADING DENSITIES

Rearing unit	Flow Based Densities (LBS/GPM/inch fish length)			Volume Based Densities (LBS/FT3/inch fish length)		
	Optimal values	Observed averages	Observed Extremes	Optimal values	Observed averages	Observed Extremes
Optimal ¹	1.20			0.30		
Raceways		1.52	7.72		.33	1.09
Circular Tanks		1.21	1.85		.13	.25
Asphalt Rearing		1.96	6.85		.03	.07
NATURES		pending	pending		Pending	pending

1. Optimal values established by staff of Northwest Indian Fisheries Commission Tribal Fish Health Center.

9.2.3 Fish rearing conditions Ponds are monitored weekly for temperature and discharge flows. Fish health is monitored monthly or as needed by staff of the NWIFC Tribal Fish Health Center.

9.2.4 Monthly fish growth information: (Fish/LBS; Grams/Fish)

TABLE 9.2.4 COHO SIZE AT TIME

	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
F/lbs	1073	689	406	269	184	124	93	68	50	37	33	30	26	22	19	16
Gm/F	.42	.66	1.12	1.69	2.47	3.67	4.90	6.67	9.17	12.2	13.8	15.3	17.4	12.0	23.8	28.4

9.2.5 Monthly fish growth rates: not available

9.2.6 Feed types used, feed rates, application information

TABLE 9.2.6 FEED TYPES AND USES

Developmental Stage	Rearing unit	Feeding Frequency	Feed Rates	Feed Manufacture	Feed Type & Size	Moisture Content
Fry to fingerling	Raceways	5x/day 7 day/wk	1.8%BW/Day	Moore Clark	Nutra Plus Starter #0,#1,#2	.06%
Fingerling	Circular tanks	3x/day 4 day/wk	1.8%BW/Day	Moore Clark	Nutra Plus Starter #3	.06%
Fingerling	Rearing ponds	1x/day 4 day/wk	1.25%BW/Day	Moore Clark	Clark's Fry 1.5mm	.06%
Fingerling	NATURES pond	Natural food /demand feeders	.65%BW/Day	Moore Clark	Clark's Fry 1.5mm, 2.0mm	.06%

- 9.2.7 Fish health monitoring, disease treatment, and sanitation: Fish health is monitored throughout the rearing period. Staff from the NWIFC Tribal Fish Health Center visits the hatchery monthly, or as needed. Staff performs routine monitoring of juvenile fish, advises hatchery staff on disease findings, and recommends disease treatments when appropriate. NWIFC staff also provides vaccinations for use in Tribal fish production programs.
- 9.2.8 Smolt development indices: Physiological indices not monitored. Behavioral indices are monitored and used to assess degree of smoltification.
- 9.2.9 Use of NATURAL rearing measures: The Lower Elwha Fish Hatchery has begun a 4 brood cycle rearing cycle study comparing coho survival under two rearing strategies. Returns to the hatchery rack by fish reared using standard hatchery rearing techniques will be compared to return to the hatchery rack of fish reared under a modified NATURES rearing strategy. Rearing conditions for the experimental fish include:
- Reduced rearing densities (projected density index of 0.006 vs 0.3 optimal target density index)
 - Increased emphasis on natural food items (supplemental feed provided via demand feeders)
 - Structure and cover provided to facilitate natural behavior
- 9.2.10 Risk aversion measures applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation: No listed fish will be subjected to propagation under this program. No known adverse genetic or ecological effects to listed natural fish will result from current coho salmon propagation practices currently employed at the Lower Elwha Fish Hatchery.

SECTION 10. RELEASE

10. describe fish release levels and release practices applied through the hatchery program: Program management goals for coho salmon at the Lower Elwha Fish Hatchery is for the annual release of 750,000 yearling smolts averaging 16 fish/LBS.

Release protocols: Coho salmon are released volitionally from the hatchery beginning in May as yearling smolts. Fish leave the hatchery's rearing ponds, pass into the facility outfall, and travel 0.75 miles to the confluence of the outfall with a side channel of the Elwha River. The side channel enters the mainstem of the Elwha River at RM .3 – an estuarine zone influenced by tidal fluctuations.

Smolts pass downstream from this confluence towards the mouth of the Elwha River, and enter directly into the Strait of Juan de Fuca, or move into a series of estuarine beach lakes (RM .1) for a short residency and acclimation period prior to movement into the Strait.

Fish release dates are timed to reduce smolt contact with chum and pink salmon during their outmigration from the Elwha River (late March through Mid-May, Peters, R.J. 1996) and with chinook smolts following their departure from the WDFW Elwha Rearing Channel (mid June to late June).

Surveys on the Elwha River during the release period indicate that following entry into the Elwha River; smolts do not move upstream (Peters, R.J. 1996)

Size uniformity of population at release time: No effort is made to produce a uniform-sized population. Average release size is targeted at 16 fish/LBS and individual fish size varies around this average.

Residualization controls: Rates of residualism are not monitored.

10.1 Proposed fish release levels:

TABLE 10.1 PROPOSED COHO RELEASES

Age Class	Max release #	Fish Size Fish/LBS)	Release Date	Location
Eggs	0	na	na	na
Unfed Fry	0	na	na	na
Fry	0	na	Na	na
Fingerling	0	na	Na	na
Yearling	750,000	16	05.01 to 05.30	Elwha River

10.2 Specific location of proposed releases

10.2.1 River: Elwha River WRIA 18.0274

10.2.2 Release point:

10.2.3 Major Watershed: Elwha River

10.2.4 Basin or Region: Strait of Juan de Fuca

10.3 Actual numbers and size of fish released by age class through the program:

TABLE 10.3 HISTORICAL COHO RELEASES

Year	Juveniles Released	Average Size (Fish/LBS)	Release Biomass (LBS)
1988	768,604	16	48,037
1989	668,646	15.1	44,281
1990	755,621	14.9	50,713
1991	580,000	12	48,333
1992	707,713	12.7	55,725
1993	801,000	14.5	55,241
1994	722,221	15	48,148
1995	644,227	14.8	43,528
1996	867,379	16.6	52,251
1997	905,436	18.2	49,749
1998	684,856	16.4	41,811

1999*	789,101	15	44,970
2000	622,231	15.2	43,431
2001	Pending	Pending	Pending
2002	Pending	Pending	Pending
Average	742,084	14.9	49,804

- 494,610 from Lower Elwha Hatchery & xxx,xxx from WDFW Elwha Rearing Channel

10.4 Actual dates of release and release protocol description:

TABLE 10.4 COHO RELEASE DATES

Year	Life History Stage	Start Release	End Release
1988	Smolt	04.16.1990	05.21.1990
1989	Smolt	04.24.1991	05.17.1991
1990	Smolt	03.24.1992	05.11.1992
1991	Smolt	03.12.1993	05.10.1993
1992	Smolt	04.18.1994	04.28.1994
1993	Smolt	05.04.1995	05.12.1995
1994	Smolt	04.03.1996	05.07.1996
1995	Smolt	04.17.1997	05.19.1997
1996	Smolt	05.04.1998	05.13.1998
1997	Smolt	05.03.1999	05.17.1999
1998	Smolt	04.28.2000	05.24.2000
1999	Smolt	04.17.2001	05.15.2001
2000	Smolt	04.18.2002	05.28.2002
2001	Smolt	Pending	Pending
2002	Smolt	Pending	Pending

10.4.1 Rationale for choosing release dates: Release dates have been chosen based upon smolt readiness (pre-smolt behavior changes, scale loss, feed response) and upon the movements of the offspring of naturally-spawning salmonids in the Elwha River (chum, pink, coho, chinook, steelhead). Since 1996, hatchery release dates have been delayed until mid-May to insure that potential for predation upon these populations is minimized (Peters, R.J. 1996).

10.5 Fish transportation procedures: No transportation of fish occurs during the release phase.

10.6 Acclimation procedures: No acclimation procedures occur during the release phase.

10.7 Marks and proportions of total hatchery population marked, to identify hatchery fish

TABLE 10.7 COHO MARKING LEVELS

[illegible]

1/ fish which shed CWT's are listed as marked and untagged

- 10.8 Disposition plans for fish identified at the time of release as surplus to programmed/approved levels: Fish in excess to programmed levels will be disposed of prior to the release stage.
- 10.9 Fish health certification procedures applied pre-release: Representative samples of pre-smolts are taken by staff of the NWIFC Tribal Fish Health Center for diagnostic analysis.
- 10.10 Emergency release procedures in response to flooding or water system failure
 - 10.10.1 If emergency occurs prior to scheduled release: Emergency situation will be evaluated and addressed if possible. If emergency cannot be resolved, feeding will be halted and release of fish will begin based upon
 - 10.10.1.1 Loading density of fish in rearing ponds
 - 10.10.1.2 Overall fish health status
 - 10.10.2 If emergency occurs during release:
 - 10.10.2.1 In the event of flooding: The facility is currently protected by a flood control levee constructed by the Army Corps of Engineers. Following levee construction, the facility has been free of impacts and flooding. During a flood event on-going releases of fish would have to be halted until the end of the event.
 - 10.10.2.2 In the event of water system failure: water distribution pattern would be evaluated and altered to insure an even distribution of remaining water sources to rearing ponds
- 10.11 Given the perceived risks associated with hatchery programs (see Section 3.5), hatchery coho salmon are reared and released in a manner to minimize potential negative impacts on listed chinook salmon and bull trout populations. These risk aversion measures applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases: The Lower Elwha Fisheries Office conducts annual surveys of estuarine habitat prior to coho smolt release periods to evaluate movements of natural-origin fish from the system. The presence or absence of critical stocks in these habitats is used annually to establish release schedules from the hatchery. The timing of fish releases from the Lower Elwha Fish Hatchery have since 1996 been altered so that smolt releases occur either following the movement of fish from the system (in the case of pink and chum salmon) or prior to the movement of fish from the system periods (as in the case of chinook salmon).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

- 11.1 Monitoring and evaluation of "Performance Indicators" presented in section 1.10:
 - 11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program:

11.1.1 Performance Indicator Monitoring and Evaluation Plans

Program Goal	Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
1.8.1 Provide fish for harvest opportunity	Hatchery production of 750,000 smolts contribute to harvest and escapement goals and maintains Tribal Treaty harvest rights by providing surplus coho for in-river fisheries	Tribal treaty harvest upon coho salmon are continued	Puget Sound Salmon Management Plan, Comprehensive Coho Management Plan (draft), Annual Coho Salmon Harvest Regulation
		Annual targeted harvest rates of hatchery stocks are not exceeded	
		Cultural events focusing upon tribal salmon-based traditions continue	
	Hatchery production of coho salmon meets the juvenile goal of 750,000 smolts	A hatchery escapement goal of 1,600 brood stock is attained	Lower Elwha Fish Hatchery Operations Plan
		1,600 broodstock for hatchery escapement which will produce necessary component of minimum spawners	
		1,200 spawners which will produce eggs necessary to meet annual hatchery production goal	
		Egg take of 1.2 million eggs will achieve an overall survival sufficient to produce 750,000 outmigrating smolts from the hatchery	
	Fish diseases will be detected and treated when necessary to maintain and improve health in hatchery production	Returning adult broodstock will be tested at levels sufficient to detect viral and bacterial infections	Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Lower Elwha Fish Hatchery Operations Plan. Tribal Fish Health Center Services Manual. AFS Bluebook.
		Eggs will receive appropriate disinfection during incubation period to minimize fungal and bacterial infections	Lower Elwha Fish Hatchery Operations Plan. Tribal Fish Health Center Services Manual. AFS Bluebook.

		Health of hatchery stocks will be monitored on a monthly basis and preventative actions/strategies to maintain fish health will be recommended	Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Lower Elwha Fish Hatchery Operations Plan. Tribal Fish Health Center Services Manual. AFS Bluebook.
		Health status of pre-smolts will be assessed prior to release from the facility	Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Lower Elwha Fish Hatchery Operations Plan. Tribal Fish Health Center Services Manual. AFS Bluebook.
1.8.2 Minimize adverse ecological and behavioral effects upon listed stocks of chinook salmon	Hatchery production of coho salmon has a minimal impact on the numbers and survival of listed salmon stocks	Aggressively pursue the implementation and NATURES rearing methodology and disseminate the results of this research regionally	Lower Elwha Enriched Rearing Environment Study
		In-river terminal harvests of non-listed species scheduled to limit (prevent?) harvest of adult chinook	Annual Coho Regulation. Lower Elwha Klallam Tribe.
		Adult chinook are not targeted by broodstock capture program, adult chinook volunteering to hatchery rack are returned to river or transported to WDFW Elwha Rearing Channel	Lower Elwha Fish Hatchery Operations Plan.
		Release of coho smolts is delayed until chum and pink salmon smolts have emigrated or have reached a length of 45 mm and will be	
		Release of coho smolts will be completed prior to the release of chinook smolts from the WDFW facility	

11.1.1.2 Monitoring Plans

11.1.1.2.1 Lower Elwha Fish Hatchery Operations Plan

11.1.1.2.2 Puget Sound Salmon Management Plan

11.1.1.2.3 Draft Comprehensive Coho Management Plan

11.1.1.2.4 Draft Comprehensive Chinook Management Plan

11.1.2 Indicate whether funding, staffing and other support logistics are available or committed to allow implementation of the monitoring and evaluation process:

TABLE 11.1.2 FUNDING AND STAFFING AVAILABILITY

Performance Indicator	Monitoring Needs		Evaluation Needs	
	Funding Available?	Staffing Available?	Funding Available?	Staffing Available?
Tribal treaty harvests upon coho are continued	Y	Y	Y	Y
Annual targeted harvest rates of hatchery stock is not exceeded	Y	Y	Y	Y
Cultural events focusing upon salmon-based traditions continue	Y	Y	Y	Y
A hatchery escapement goal of 1,600 brood stock is attained	Y	Y	Y	Y
1,600 broodstock for hatchery escapement which will produce necessary component of minimum spawners	Y	Y	Y	Y
1,200 spawners which will produce eggs necessary to meet annual hatchery production goal	Y	Y	Y	Y
Egg take of 1.2 million eggs will achieve overall survival of 62.5 % to produce 750,000 outmigrating smolts from the hatchery	Y	Y	Y	Y
Returning adult broodstock will be tested at levels sufficient to detect viral and bacterial infections	Y	Y	Y	Y
Eggs will receive appropriate disinfection during incubation period to minimize fungal and bacterial infections	Y	Y	Y	Y
During the rearing period fish will be routinely sampled to assess and maintain appropriate levels of fish health	Y	Y	Y	Y
Health status of pre-smolts will be assessed prior to release from the facility	Y	Y	Y	Y
In-river terminal harvests of non-listed species scheduled to limit (prevent?) harvest of adult	Y	Y	Y	Y

chinook				
Adult chinook are not targeted by broodstock capture program, adult chinook volunteering to hatchery rack are returned to river or transported to WDFW Elwha Rearing Channel	Y	Y	Y	Y
Release of coho smolts is delayed until chum and pink salmon smolts have emigrated or have reached a length of 45 mm	Y	Y	Y	Y
Release of coho smolts completed prior to release of chinook smolts from WDFW facility	Y	Y	Y	Y

- 11.2 Risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities: no adverse genetic and ecological effects to listed fish are expected to result from monitoring and evaluation activities.

SECTION 12 RESEARCH

- 12.1 **Objective or purpose:** A comparative study of adult returns to the hatchery rack by fish reared under two strategies: conventional hatchery methodology and a modified NATURAL rearing techniques incorporating reduced rearing densities and the availability of natural food items and natural cover for refuge.
- 12.1.1 Cooperating and funding agencies: Elwha Klallam Tribe; North Olympic Salmon Coalition, NWIFC.
- 12.1.2 Principle investigator and staff: Larry Ward, Mitch Boyd.
- 12.1.3 Status of stock affected by project: See Section 2.
- 12.1.4 Techniques: In July and August of each year, 100,000 fingerling coho will be removed from conventional hatchery rearing vessels, be given a unique coded wire tag and marked with an adipose fin clip. Following tagging, fish will be transferred to a 1.5 acre earthen pond where they will remain until release the following May. Fish will be permitted to forage for natural food items although supplemental feed will be provided to the fish by means of a demand feeder (feed rate 0.3% BW/Day). During the rearing period fish will be periodically sampled to evaluate growth, physical condition and stomach content. Fish will be volitionally released from the rearing pond and inventoried as they depart. Survival to release and total release numbers will be determined using a fish counter. Hatchery staff will sample annually 100% of returning adults and precocious males electronically. Any coded wire tags encountered will be removed and sent to the WDFW head lab in Olympia, WA for removal and analysis.
- 12.1.5 Dates or time period in which research activity occurs: The project was begun July 1999, will extend over a period of four complete brood years, with rearing and release of fish continuing through May 2004, data collection began in October 2000 and is scheduled to continue for a period of 7 years (through adult returns in brood year 2006).
- 12.1.6 Care and maintenance of live fish or eggs, holding duration, transport methods:

Protocols for the care and maintenance of live fish or eggs will follow those detailed in section 9.

12.1.7 Expected type and effects of take and potential for injury or mortality: no take of ESA listed stocks expected from coho rearing research project.

12.1.8 Level of take of listed fish: no take ESA listed stocks expected from coho rearing research project.

12.1.9 Alternative methods to achieve project objectives: NA

12.1.10 List species similar or related to the threatened species: NA

12.1.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injuries, or mortality to listed fish as a result of the proposed research activities: Release protocols for study fish will following those detailed in section 10.11

12.2 **Objective or purpose:** An analysis of outmigration timing of both natural-origin and hatchery-origin fish on the Elwha River: A screw-trap stationed at RM 0.6 will be operated from April to July 2003 and will monitor the downstream movement of salmonids in the Elwha River.

12.2.1 Cooperating and funding agencies: Elwha Klallam Tribe; NWFSC; NWIFC.

12.2.2 Principle investigator and staff: Mike McHenry

12.2.3 Status of stock affected by project: See Section 2.

12.2.4 Techniques: A screw-trap stationed at RM 0.6 will be operated in the Elwha River to monitor the downstream movement of salmonids in the Elwha River. Fish captured by the trap will be counted, measured and their origin established, if possible. Fish of hatchery origin will have their gastric contents sampled to evaluate potential predation by hatchery-origin fish on natural origin fish.

12.2.5 Dates or time period in which research activity occurs: March to June 2003 (February to July 2004).

12.2.6 Care and maintenance of live fish or eggs, holding duration, transport methods: Detailed protocols for handling fish are pending and will be included in an updated HGMP.

12.2.7 Expected type and effects of take and potential for injury or mortality: See Section 12.2.6.

12.2.8 Level of take of listed fish: See Section 12.2.6.

12.2.9 Alternative methods to achieve project objectives: NA

12.2.10 List species similar or related to the threatened species: NA

12.2.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injuries, or mortality to listed fish as a result of the proposed research activities: See Section 12.2.6.

12.3 **Objective or purpose:** An analysis of distribution, density, habitat utilization and interactions of salmonid species in the Elwha River.

12.3.1 Cooperating and funding agencies: Elwha Klallam Tribe; NWFSC; NWIFC.

12.3.2 Principle investigator and staff: Mike McHenry

12.3.3 Status of stock affected by project: See Section 2.

12.3.4 Techniques: Multi-agency staff is conducting snorkel survey throughout the lower Elwha River. During these surveys investigators will visually determine distribution, habitat utilization, population numbers and interactions between salmonid species in the Elwha River.

12.3.5 Dates or time period in which research activity occurs: Project was initiated 2000 and is scheduled to continue through 2006 (and beyond, depending upon funding. Snorkel surveys occur quarterly/seasonally.

12.3.6 Care and maintenance of live fish or eggs, holding duration, transport methods: NA.

- 12.3.7 Expected type and effects of take and potential for injury or mortality: No handling of fish will occur. No take/potential injury or mortality of fish expected..
- 12.3.8 Level of take of listed fish: NA.
- 12.3.9 Alternative methods to achieve project objectives: NA
- 12.3.10 List species similar or related to the threatened species: NA
- 12.3.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injuries, or mortality to listed fish as a result of the proposed research activities: Fish will not be handled or subjected to deleterious stressors.

SECTION 13. ATTACHMENTS CITATIONS AND PERMITS

13.1 Attachments

13.1.1 Lower Elwha Fish Hatchery Operational Plan

13.1.2 Annual Coho Salmon Harvest Regulation. 2000. Lower Elwha Fisheries Office

13.2 Literature Cited

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Washington Department of Fish and Wildlife, Point No Point Treaty Council and Makah Tribe. 1999. 1999 Management Framework Plan and Salmon Runs' status for the Strait of Juan de Fuca Region.

13.3 Permits

National Pollutant Discharge Elimination System. Permit No. WA-G13-1000 (*Pending*). Tribal Hatcheries and other Upland Aquaculture Facilities in the State of Washington. 2000.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

“ I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that the information provided in the HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C. 1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant: Larry Ward, Fisheries Biologist

Certified by:_____ Date:_____

Lower Elwha Fish Hatchery Hatchery Operational Plan

Introduction

The hatchery is located on the Elwha River. Constructed in 1976 the hatchery has been in continuous operation, initially as a chum salmon facility, and currently in the production of coho and steelhead salmon. Rearing containers include 24 concrete raceways (4'x40'), eight fiberglass circular tanks (24 ' diameter), four 0.5 acre asphalt rearing ponds, one 1.5 acre earthen rearing pond, and an earthen adult holding pond. Incubation consists of vertical stack incubators with an instantaneous incubation capacity of 6.7 million eggs. Water for the facility is supplied from wells and a gravity-flow infiltration system located on the Elwha River. The Lower Elwha Hatchery serves as the major production source of winter coho and winter steelhead salmon for the Elwha River.

Purpose And Goals

The Lower Elwha Hatchery production goal is to produce coho and steelhead smolts for in-river (Elwha River specific) terminal harvest opportunity (commercial, subsistence, ceremonial, and recreational).

Objectives

Objective 1: Hatchery Production

Coho Salmon:

Collect 1,200,000 winter coho eggs

Rear and release 750,000 yearling coho smolts on-station

Steelhead Salmon:

Collect 160,000 winter steelhead salmon eggs

Rear 150,000 yearling winter steelhead pre-smolts

Transfer up to 60,000 yearling steelhead pre-smolts to the WDFW Elwha Rearing Channel for imprinting, final rearing and release.

Release up to 150,000 yearling steelhead smolts on-station

Chum Salmon:

Collect up to 100,000 chum salmon eggs

Rear for release or outplanting 75,000 eyed eggs or fed fry

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies

Objective 3: Maintain stock integrity and genetic diversity of each stock through proper management of genetic resources

Objective 4: Maximize survival at all life history phases using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with tribal, state, and federal water quality standards

Objective 6: Communicate effectively with other fisheries managers in the region

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection and Disposition

The primary intent of the adult collection program at the Lower Elwha Hatchery is to collect enough adults of each species to maintain each of the program while meeting guideline designed to maintain genetic diversity of stocks. Brood fish are permitted to voluntarily return to the facility. Fish enter the facility by means of an outfall creek constructed for the hatchery. At the head of the outfall creek is a trap with the fish enter. In the trap fish are sorted one to two times per week for species, sex, and state of sexual ripeness. Green males and females are held separately prior to spawning.

Winter Coho Salmon: Coho return to the hatchery from October to November with peak spawning in November and December.

Winter Steelhead Salmon: Winter steelhead return to the hatchery from December to February with peak spawning taking place in January.

Chum Salmon: Chum salmon return to the Elwha River from October to December with peak spawning in December.

Spawning

GENERAL PROTOCOLS: Male to female spawning ratio will be 1:1. Precocious males (jacks) will be spawned at a rate not to exceed 5% of the total male spawning component. Sperm from individual males will be kept separate prior to fertilization in order to maximize genetic input and potential representation of individual genetic material. Eggs from 20 females are pooled.

FISH HEALTH CERTIFICATION:

Coho: Adult female salmon are sampled at 60 kidney/spleen samples and 150 ovarian fluid samples annually for viral analysis.

Steelhead: 100% of all females spawned have both kidney/spleen and ovarian fluid sampled for viral analysis.

Chum: 100% of females spawned at the hatchery have both kidney/spleen and ovarian fluid sampled for viral analysis.

Fertilization and Incubation

Eggs and sperm are fertilized mixed at a rate 1 male to 1 female. Due to the mixing of eggs this produces an effective 20:20 spawning matrix.

Fertilized eggs are trayed-out into vertical stack incubators within 5 minutes of being fertilized and are water hardened for a minimum 60 minutes in a 100 PPM solution of PVP iodine. Traying rates at this point do not exceed 12,000 eggs per tray. Following water hardening eggs are incubated in pathogen-free well water (48° F constant water temperature). Incubator flows are 3.0 GPM.

During the incubational period eggs receive a prophylactic formalin treatment (167 PPM for 15 minutes, 3 days in 10) to prevent fungus colonization.

As eggs reach the eyed stage the eggs are physically shocked, non-viable eggs are removed, and inventories are taken to assess inventories and establish rates of survival to the eyed stage of physiological development.

Eggs are re-trayed at a rate not exceeding 5,000 eggs per tray for the final incubational period.

Anti-fungal prophylactic formalin treatments are terminated 10 days prior to hatching to limit potential formalin-related hatching mortalities.

Following initial incubation (600 CTU °F) all or a portion of the eyed chum eggs are transferred into remote egg incubators (Jordan-Scotty Salmon Condominiums ©, Scott Plastics LTD, Victoria, BC). Planting densities were 1,000 eggs per incubator unit. These incubators are then buried in gravel 6 to 12 inches below grade

Ponding of fry occurs following the absorption of egg material. Fry are manually transported from incubation facilities to raceways and feeding is initiated.

Carcass Disposition

Adult salmon collected in excess of hatchery production needs will be made available to tribal community members for ceremonial purposes, regional food banks, or other organizations and groups identified by Tribal Council as qualifying for receipt.

Following spawning, carcasses will be returned when appropriate, to the Elwha River to facilitate in-river nutrient enhancement.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies

Rearing and Release Strategies (General)

Rearing and release strategies are intended to limit the amount of ecological interactions occurring between fish originating in the hatchery, naturally-spawning populations of fish in the river, and ESA listed stocks of chinook salmon. Fish are reared to sufficient size

to encourage a high degree of smoltification so that residualism after release is minimized. Rearing on Elwha River water ensures a strong homing to the hatchery, thus reducing straying of fish into other areas.

Rearing Strategies

Fish are to be reared in accordance with standards identified as optimal by the staff of the Tribal Fish Health Center (NWIFC). These recommended guidelines ensure rearing environment parameters do not adversely impact fish. The guidelines are based upon both flow and volume.

Fish are sampled twice a month for growth and once per month to assess fish health status. Additional sampling occurs on an as-needed basis.

Release Goals (General)

Winter Coho Salmon: Rear 750,000 yearling smolts to a size of 16 Fish/LBS for release in May

Winter Steelhead Salmon: Rear 120,000 yearling smolts to a size of 9 to 6 Fish/LBS for release in May

Chum Salmon: Rear up to 75,000 chum eggs or fry to the eyed stage (eggs) or to a length of 45mm.

Release Strategies

Coho and Steelhead are volitionally-released from the facility. Smoltification is monitored upon the basis of behavior (non-physiologically). Releases begin following the identification of those behaviors indicative of smoltification.

Chum reared at the hatchery are transported and released once a minimum size of 45mm is attained.

Objective 3: Maintain stock integrity and genetic diversity of each stock through proper management of genetic resources

Adult Collection

Both coho and steelhead adults are collected throughout the entire run to ensure that the run timing of this stock is maintained. All chum salmon adults collected are utilized for egg production.

Spawning and Fertilization Protocols

Coho: Program goal is to spawn 1,200 adults. Male to female spawning ratio will be 1:1. Precocious males (jacks) will be spawned at a rate not to exceed 5% of the total male spawning component. Eggs are pooled in lots of 20 females. Eggs and sperm are fertilized functionally at a rate 1 male to 1 female. The effective fertilization rate of this spawning matrix is 20:20, due to the pooling of eggs.

Steelhead: Program goal is to spawn 120 adults.

Chum: Program goal is to spawn 75 adults.

Objective 4: Maximize survival at all life history phases using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens

Fish health will be maintained throughout the rearing and release phase by adhering to the guidelines of *the American Fisheries Society Fish Health Section Blue Book*, *The Tribal Fish Health Center Services Manual*, and *the Salmonid Disease Control Policy of the Co-Managers of Washington State*.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with tribal, state, and federal water quality standards

Environmental Monitoring

Environmental monitoring is conducted at tribal facilities with more than 20,000 pounds of annual production to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Environmental Protection Agency (EPA). Monitoring is also used in managing fish health. The Lower Elwha Fish Hatchery is covered under NPDES permit number WA-G13-1000 (*pending*), which details monitoring parameters and frequencies.

Hatchery Water Supply

Elwha River: The Elwha River has suffered significant down cutting, loss of sediment, loss of channel variability and complexity since the construction of two hydroelectric projects in the early portion of the 20th century. Channelization of the river has reduced the production potential of the facility's infiltration system. Water right is 12 CFS.

Wells: The hatchery is supplied by two production wells. Total water production is currently 4 CFS.

Domestic Water: The hatchery has a well that provides the facility with domestic water. No identified water right exists.

Objective 6: Communicate effectively with other fisheries managers in the region

Record Keeping

Hatchery records pertaining to fish production, feed, use of disease therapeutics, are kept in a consistent manner employing standard formats to provide long term documentation of hatchery activities and monitoring of performance.

Quarterly Reports

Hatchery activities are reported quarterly. These reports detail all hatchery activities occurring during the quarter.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Elwha River watershed has been developed. It documents existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects annual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

The **Management Framework Plan and Salmon Runs' Status for the Strait of Juan de Fuca** is an annual document which fulfills the reporting requirements under the provisions of Section 5.2 of the **Puget Sound Salmon Management Plan** and facilitates the management of salmon runs in the Strait of Juan de Fuca. This report establishes estimates of abundance, anticipated harvests, and agreed-upon escapement goals for each management unit.